2.3 Extension--Truth tables

Conditional statements can be written using symbolic notation.

If p, then q. p—hypothesis q—conclusion

p→q "if p, then q" or "p implies q"

Symbolic Notation

Conditional $p \to q$

Converse $q \to p$

Inverse $\sim p \to \sim q$

Contrapositive $\sim q \to \sim p$

Biconditional $p \leftrightarrow q$

Sep 28-1:01 PM

The truth value of a statement is either true (T) or false (F).
A truth table shows the conditions when a conditional statement is true.
It is only false when a true hypothesis produces a false conclusion.

Truth Table for Conditional

p	q	p→q
T	T	T
T	F	F
F	T	T
F	F	T

Sep 28-1:02 PM

Specific Example:

If it is raining, then you have an umbrella.

It's raining and you don't have an umbrella.

It's not raining and you don't have an umbrella.

It's not raining and you have an umbrella.

Oct 1-9:22 AM

p	q	p→q	q→p	~p→~q	~q→~p
T	T	T	T	T	T
T	F	F	T	T	F
F	T	T	F	F	T
F	F	T	T	T	T

Jun 20-12:38 PM

Examples:
Make a truth table for the logical statement.
$p \rightarrow \sim q$

p	q	$\sim q$	$p \rightarrow \sim q$
T	T	F	F
T	F	T	T
F	T	F	T
F	F	T	T

Jun 20-12:28 PM

$\sim(p \rightarrow q)$

p	q	$(p \rightarrow q)$	$\sim(p \rightarrow q)$
T	T	T	F
T	F	F	T
F	T	T	F
F	F	T	F

Sep 28-1:11 PM

Truth tables can also be made for conjunctions (and) and disjunctions (or).

"p and q" is true only when both p and q are true (symbolic $p \wedge q$)

"p or q" is false only when both p and q are false (symbolic $p \vee q$)

Only T Both True

Only F when Both F

Conjunction		
p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction		
p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

Sep 28-1:12 PM

Ex: $\sim p \vee q$

p	q	~p	$\sim p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

Sep 28-1:31 PM

ex: $(p \vee q) \wedge \sim r$

p	q	r	p ∨ q	~r	
T	T	T	T	F	F
T	F	T	T	F	F
T	T	F	T	T	T
T	F	F	T	T	T
F	T	T	T	F	F
F	F	T	F	F	F
F	T	F	T	T	T
F	F	F	F	T	F

Sep 28-1:32 PM

HW
p95 #1-3, 7, 9, 10

Sep 28-1:32 PM

1. **WRITING** *Describe* how to use symbolic notation to represent the contrapositive of a conditional statement.

WRITING STATEMENTS **Use *p* and *q* to write the symbolic statement in words.**

p: Polygon *ABCDE* is equiangular and equilateral.

q: Polygon *ABCDE* is a regular polygon.

2. $p \rightarrow q$ 3. $\sim p$

MAKING TRUTH TABLES **Make a truth table for the logical statement.**

7. $\sim p \rightarrow q$ 9. $\sim (q \rightarrow p)$

0. **LOGICAL EQUIVALENCE** The truth table shows that the *conjunction* "*p* and *q*" is true only when *p* and *q* are both true. It also shows that the *disjunction* "*p* or *q*" is false only when *p* and *q* are both false.

a. Make a truth table for $\sim (p \text{ or } q)$.

b. Make a truth table for $(\sim p \text{ and } \sim q)$.

c. Show that $\sim (p \text{ or } q)$ and $(\sim p \text{ and } \sim q)$ are logically equivalent.

p	*q*	Conjunction *p* and *q*	Disjunction *p* or *q*
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	F

Oct 1-9:10 AM